

Biosafety at the State Laboratory Institute

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Biosafety at the State Laboratory Institute

All employees trained to work in BL2 & BL3 laboratories must abide by the SLI Exposure Control and Universal Precautions Plan and the SLI Biological Hazard Post Exposure Plan, follow all recommended bloodborne pathogen, universal precaution, and transfer procedures. Employees working with select agents must practice the recommended guidelines and precautions for BL2 and BL3 practices and facilities as set forth in the U.S. Department of Health and Human Services manual entitled Biosafety in Microbiological and Biomedical Laboratories. All employees must follow the protocols as specified in designated laboratory procedural manuals specific to each agent.

Laboratory-Acquired Infections

Harding & Byers (2000)

1979-1999 Clinical, research, teaching,
public health and production
facilities

1,267 cases and 22 deaths

TB, Q fever, hantavirus and arboviruses

Biosafety for BL2 and BL3 Agents

- Understanding the risks
 - Controlling the risks
 - Minimizing the risks
-
- Know what to do in an emergency
 - Follow established rules, SOPs and signs
 - Wear required PPE
 - Handle hazardous materials appropriately
 - Operate equipment correctly
 - Avoid or minimize risks
 - Remove, repair or report safety hazards
 - Report accidents promptly
 - Contribute to work zone safety
 - Participate in safety training

Understanding the Risks-- Biosafety Hazard Levels 1-4

- BL-1**: Not known to consistently cause disease in adults
- BL-2**: Pathogenic through puncture, mucous membrane exposure, non-intact skin contact
- BL-3**: Pathogenic through aerosol transmission or highly hazardous in large quantities
- BL-4**: Very high risk agent, high risk of life threatening disease

Understanding the Risks-- Biohazard Occupational Risks

For common, blood-borne human viruses:

- Hepatitis B:** 0.6 - 30% chance of contracting disease if exposed to HBV+ blood
- Hepatitis C:** 3 - 10% chance of contracting disease if exposed to hepatitis C+ blood
- HIV:** 0.4% chance of contracting disease if exposed to HIV+ blood

•**Conclusion:** *Hepatitis B is much more transmissible than HIV; fortunately HBV is preventable through vaccination.*

Understanding the Risks-- Potentially Infectious Materials

- BL2

- Human-based materials: blood, plasma and blood-derived products, body fluids (i.e. synovial fluid, semen, vaginal secretions), tissues and organs

- Suspect animal samples or derived cultures

- Suspect samples sent for cultures (food, etc.)

- Suspect cultures of bacteria, virus, mold

- BL3

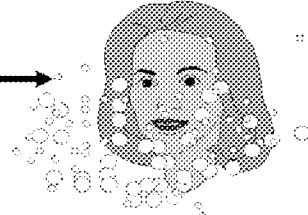
- Treat all suspect samples for BL3 agent testing at BL3 level until determination is made.

Understanding the Risks-- Known Infectious Materials

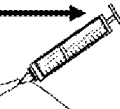
- Cultures/controls of BL2 agents
 - Examples: *C. tetanii*, *C. diptheria*, Hepatitis B, Hepatitis C, Human Immunodeficiency Virus (HIV), EEE Virus
- Confirmed positive human or animal samples
- Cultures/controls of BL3 agents
 - Examples: West Nile Virus, Brucella species

Understanding the Risks-- Routes of Exposure for BL2 Agents

- **Mucous membrane contact** →
Splashes to: eyes, nose, mouth



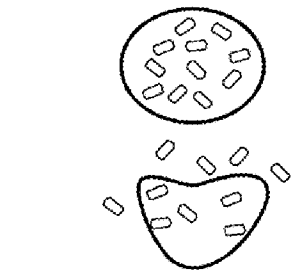
- **Injection** →
Eliminate needles and other "sharps"
whenever possible!



- **Compromised skin contact** →
Contact with: skin rashes, cuts, excema



Understanding the Risks-- Properties & Hazards of BL2 Aerosols



Example:

Droplet of human serum is released with hepatitis B virus present.



Droplet eventually breaks, releasing hepatitis virus.



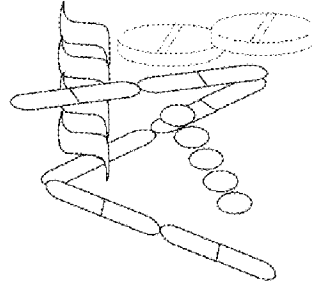
Live virus is hazardous if contact with mucous membranes or non-intact skin occurs. HBV can survive 1+ week.

Understanding the Risks-- Universal Precautions

- Treat all biological materials as potentially infectious
- Do not eat, drink, store food in presence of biological materials or work areas
- Minimize spills, droplets, aerosols
- Restrict use of needles and other "sharps"
- Use personal protective equipment
- Use engineering controls
- Disinfect work surfaces & waste
- Wash hands after glove removal

Understanding the Risks-- Blood-Borne Pathogens

- The following agents can be present in blood and blood products:
 - Hepatitis B virus
 - Hepatitis C virus
 - Human immunodeficiency virus (HIV)
 - And potentially many others, including:
 - cytomegalovirus (CMV)
 - toxoplasma gondii (toxoplasma)
 - tick-borne diseases
 - and many other bacteria, viruses, parasites, fungi!



Controlling the Risks-- Hepatitis B Vaccine Program

- Hepatitis B is preventable by vaccination.
- Vaccine is administered at:
 - Lemuel Shattuck Hospital* for DPH employees;
 - New England Baptist Hospital* for UMMS employees.
- Vaccine is free of charge to all employees; employees can start program at any time.

Controlling the Risks-- Biosafety SOPs

- Exposure Control Plan & Universal Precautions:
Bloodborne Pathogens and BL2 Agents - 10OH004
- Biohazard Disinfection - SOP10OH002
- Biohazardous Waste Disposal - 10FC002
- Hepatitis B Vaccination Protocol - SOP010H005

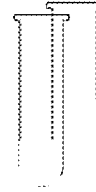
Controlling the Risks-- Biosafety Work Practices

- **Engineering Controls**

- Biosafety cabinet: for bioaerosol-generating activities, such as:
 - removing specimens, cultures from centrifuge rotor
 - pipetting/aliquoting pathogenic cultures or confirmed positive human samples
- Chemical hood: for flammable, corrosive, toxic chemicals
- Vented balance station: for weighing toxic solids
- Pipet tips: aerosol-protected tips recommended
- Sharps container: Use for ALL sharps, including Pastuer pipets
- Secondary Containers: required for transport, storage of biohazards
- Splash Shields: use on bench top if splashing can occur
- Protected vacuum lines: HEPA filter on exhaust + double trap

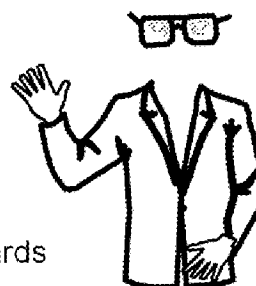
Controlling the Risks-- Biosafety Work Practices

- Centrifugation
 - Use tubes with O-ring seals
 - Remove rotor head from centrifuge
 - Open rotor in biosafety cabinet
 - Disinfect rotor if spill observed
- Note: Centrifugation accidents pose a significant chance of droplet contact



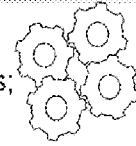
Controlling the Risks-- Personal Protective Equipment

- Lab coat
- Safety glasses
- Face shield (if splashing can occur)
- Gloves
 - Cover cuts/rashes with bandages
 - N-Dex nitrile (blue) OR latex for biohazards
 - N-Dex for most chemicals
 - Wash hands after glove removal
 - DO NOT wear gloves outside of labs!



Controlling the Risks-- Engineering Controls

- **Sharps container:** for ALL sharps, even Pastuer pipets!
- **Secondary Containers:** for transport/storage of biohazards;
RED ziploc bags require no additional labeling
- **Benchtop pads:** remove daily
- **Splash Shields:** use on benchtop if splashing can occur
- **Instrument Shields:** use for instruments if splashing can occur
- **Labels:** lab entrances, contaminated equipment, secondary containers
 - **"Biohazard" Labels:** use on equipment/items requiring gloves
 - **"Decontaminated Equipment" Labels:** use for equipment to be moved, stored or sent for repair--Form CSS-2 in stock room



Controlling the Risks-- Marking Decontaminated Equipment

- Use Decontaminated Equipment Label
- (Forms #CSS-2 10/pkg.) for
 - Equipment removed from lab for:
 - storage
 - relocation
 - disposal, OR
 - Equipment within the lab that requires:
 - service
 - temporary shutdown

| DECONTAMINATED EQUIPMENT | |
|--|----------------|
| Equipment | _____ |
| Form #/Rev. | _____ 06/05/07 |
| Date of Decontamination | _____ |
| Decontamination Performed | |
| _____ | |
| <input type="checkbox"/> Biohazard | |
| <input type="checkbox"/> Chemical | |
| <input type="checkbox"/> Radioactive | |
| <input type="checkbox"/> None Required | |

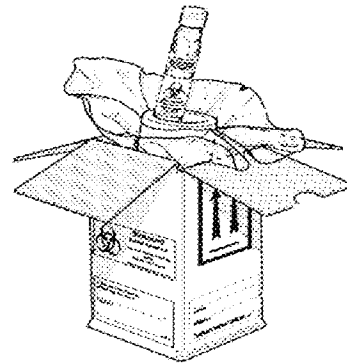
Controlling the Risks-- Biosafety Cabinets

- Biosafety Cabinet Tips

- Turn OFF UV light when entering room
 - Turn ON audible alarm
 - Close all lab doors before using BSC
 - Position sash at pre-set level
 - Use slow, deliberate movements
 - Collect wastes within cabinet
 - Disinfect work surface with disinfectant after use
 - For recirculating units cabinets, turn on cabinet, allow to run for >5 minutes before work and 5 minutes after work.
 - Utilize on-line training program in "Why Not Learn"
- Contact: Julie Sullivan, ext. 6255

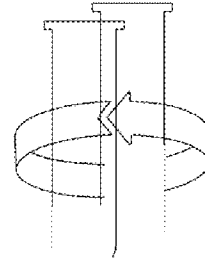
Controlling the Risks-- Shipping Biological Materials

- Shipping known infectious samples:
 - Special packaging required (Class 6.2) for known positive shipments.
 - Receiving infectious materials
 - Open outer box on bench
 - Open inner box in biosafety cabinet

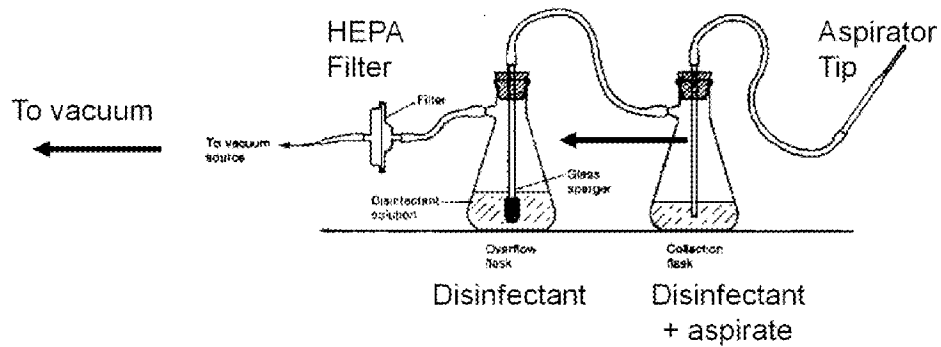


Controlling the Risks-- Handling Human/Animal Specimens

- **Vacutainer test tubes:** Open behind a shield; use gauze to cover tops of tubes.
- **Centrifuge Tubes:** Use tubes with o-ring seals when possible
- **Rotors:** Use rotor heads with safety cups whenever possible; required for known positive samples
- **Known Infectious Materials:** After spinning known positive samples, remove rotor head from centrifuge with cover intact, and open rotor in biosafety cabinet
- **Spills:** Keep rotor closed for 30 minutes to allow aerosols to settle, then disinfect rotor



Controlling the Risks-- Vacuum Aspiration of Biohazards



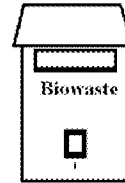
Note: Use Vesphene II-SE (vs. bleach) to prevent corrosion of vacuum system.

Controlling the Risks-- Biohazard Disinfection for BL2 Agents

- Minimum Requirements
 - Disinfect all exposed work surfaces at end of day or immediately after contamination (splash or spill)
 - *DPH*--Use Vesphene II-SE @ 1/2 oz/gallon, 10 minute contact for surfaces
 - Use only approved disinfectants & protocols

Controlling the Risks-- Biohazardous Waste Disposal

- **Autoclavable solids + liquids:** sterilize biowastes whenever possible.
 - Steam must be able to penetrate autoclave bags
 - Add water to very dry loads
 - Use autoclave tape to ensure adequate temperature
 - Use spore strips on "typical loads" to ensure adequate steam penetration
 - Log in waste



Controlling the Risks-- Biohazardous Waste Disposal

Solid biowaste: Use biohazard box for sharps containers, animal carcasses and Biolabs Plasma Thaw wastes.

- Record sharps box disposal on Sharps Manifest
- Staging areas for biowaste pick up:
 - SLI=animal quarters xxx
 - Biolabs = Plasma Thaw xxx

Minimizing the Risks-- Biohazard First Aid

- **Skin exposure:** Wash area for 15 minutes; for punctures, encourage wound to bleed.
- **Eye exposure:** Use eyewash for 15 minutes.
- **Medical Assessment:** All biohazard exposures need immediate assessment/treatment; treatment regimen for known HIV exposure should begin within 2 hours of exposure. Bring "Post Exposure Forms" to medical evaluation.
- **Documentation:** Complete an injury/illness report form within 24 hours of injury. Post exposure forms will be returned to Worker's Compensation Contact to ensure medical provider has provided necessary services.



Minimizing the Risk-- Latex Allergy

Symptoms include: Skin rash, hives, flushing of skin, itching, nasal/eye/sinus symptoms, asthma, shock (rare).

Persons at increased risk: People with multiple allergies, spina bifida, food allergies-avocado, potato, banana, tomato, chestnuts, kiwi, papaya.

Three types of latex reactions:

- Irritant contact dermatitis-most common--dry, itchy areas on skin--not a true allergy.
- Allergic contact dermatitis-similar to poison ivy, caused by exposure to chemicals added to latex during processing.
- Latex allergy (immediate hypersensitivity)-symptoms range from mild allergic reaction to anaphylactic shock (very rare).

Minimizing the Risk-- BL2 Agent Biohazard Spills

- Select any glove type
- Remove broken glass with forceps
- Decontaminate area with Wexcide; let sit for 10 minutes
- Collect all as a biohazardous waste
- Replenish all supplies for spills (including diluted Wexcide) are located in Lab Spill Kit; contact Safety to re-stock kit.



Emergency Procedures-- Biohazard Spills

- **Minimum Requirements**

- All spills must be disinfected immediately
- Remove broken glass/sharps with forceps before wiping area
- Absorb liquids with towels first, then apply disinfectant
- Use Wexcide @ 1:256 as disinfectant; minimum contact period (10 minutes or let air-dry)
- Do not spray disinfectant directly onto spill

Controlling the Risks-- Additional Information . . .

- **Related Work Instructions (“required reading”)**
- **Technical Information Center (Library)**
 - Exposure Control Plan (biosafety protocol for facility)
 - CDC's Biosafety in Microbiological/Biomedical Labs
 - Other biosafety references/videotapes available to check out
- **Safety Department**
 - Available to answer questions, review procedures and work practices, and to conduct risk assessments for new projects



Biosafety Refresher Training-- Summary

- BL-2 level operations present occupational hazards from injection, mucous membrane exposure or non-intact skin exposure.
- BL-3 level includes above plus aerosols
- PPE, engineering controls & work practices minimize the risks; they are a job requirement.
- HBV vaccine is strongly recommended for employees.